

WHAT IS CLAIMED:

1. In a transfer system for transferring workpieces between successive die stations in a stamping press having a left side, a right side, a front side and a back side, and including at least one elongate bar having a series of workpiece grippers mounted thereon for engaging workpieces at the successive die stations, a primary support arrangement adapted for mounting adjacent said stamping press, two elongate support beams mounted on said primary support arrangement and positioned on first and second opposite sides of said stamping press during use of said transfer system, and two mounting heads mounted on each support beam and horizontally movable on their respective support beam, the improvement wherein each mounting head is independently movable on its respective support beam and is selectively connectible by means of one of said at least one elongate bar to either the other mounting head mounted on the same support beam for the purpose of transferring said workpieces in a left-right flow direction relative to said press or an opposing one of the mounting heads mounted on the other support beam for the purpose of transferring said workpieces in a front-back flow direction relative to said press, and wherein each mounting head includes a coupling for detachably connecting one of said at least one bar to the mounting head, a vertical transport mechanism for moving said coupling vertically, and a lateral transport mechanism for moving said coupling in a front-back direction relative to said press, and wherein said transfer system also includes longitudinal transport drive systems for moving each of said mounting heads in a left-right direction relative to said press.

2. The system of claim 1 wherein there are four of said longitudinal transport drive systems, one for each of said mounting heads and each longitudinal transport drive system comprises a belt drive assembly including a primary drive belt mounted on the support beam for the respective mounting head and extending in the lengthwise direction of this support beam and a drive motor mounted on its respective mounting head

and having an output shaft operatively connected to a drive pulley that engages said primary drive belt.

3. The system of claim 1 wherein each vertical transport mechanism includes a supporting body mounted for vertical movement relative to its respective support beam and each lateral transport mechanism includes a horizontally extending, elongate support member mounted for substantially horizontal movement on said supporting body.

4. The system of claim 3 wherein said supporting body is a L-shaped housing having a vertical housing section and a horizontal housing section rigidly connected to each other, said elongate support member is slidably mounted in said horizontal housing section, and said lateral transport mechanism includes a lateral belt drive assembly including a lateral drive belt connected to said elongate support member and a drive motor mounted on said supporting body and having an output shaft operatively connected to a drive pulley that engages said lateral drive belt whereby, during use of said transfer system, rotation of said drive pulley causes said support member to move in the front-back direction.

5. The system of claim 3 wherein each mounting head includes a carriage assembly mounted for horizontal movement on its respective support beam, said supporting body is mounted for vertical movement on said carriage assembly, and each of said longitudinal transport drive systems is connected to a respective one of the carriage assemblies in order to move the one carriage assembly in a left-right direction during use of said transfer system.

6. The system of claim 5 wherein each longitudinal transport drive system comprises a primary belt drive assembly including a primary drive belt mounted on the support beam for the respective mounting head and extending in the lengthwise direction of this support beam and a primary drive motor mounted on its respective carriage assembly and having an

output shaft operatively connected to a primary drive pulley that engages said primary drive belt.

7. The system of claim 6 wherein each of said support beams is vertically movable on said primary support arrangement and said system includes a vertical drive unit at each end of each support beam for moving its respective support beam upwardly or downwardly as required.

8. The system of claim 7 wherein said primary supporting arrangement comprises four vertical, elongate beam-supporting posts each adapted for mounting to or adjacent to said stamping press, each end of each support beam is movably mounted on a respective one of said beam-supporting posts, and each vertical drive unit is mounted on a respective one of said beam-supporting posts.

9. The system of claim 4 wherein each drive motor is mounted on its respective vertical housing section at a location spaced above said horizontal housing section, and said drive pulley is rotatable about a horizontal axis.

10. The system of claim 1 including first and second pairs of said at least one elongate bar, the first pair of bars being substantially longer than the second pair and each of the first pair being adapted to connect the two mounting heads on a respective one of said support beams, the bars of said second pair each being adapted to connect an opposing pair of the mounting heads mounted on said support beams, wherein during use of the transfer system either said first pair of bars can be used for transferring said workpieces in a left-right flow direction or said second pair of bars can be used for transferring workpieces in a front-back flow direction.

11. A transfer system for transferring workpieces between successive die stations in a stamping press having left and right sides, a front side, and a back side, said transfer system comprising:

a substantially horizontal support beam adapted for placement adjacent one of the sides of the press;

a supporting structure for said support beam, which is adapted for mounting on said supporting structure;

at least one mounting head mounted on said support beam for horizontal movement along said support beam, the or each mounting head including a coupling for detachably connecting an elongate bar to the mounting head, said bar being adapted to mount a series of workpiece holders for engaging workpieces at the successive die stations, a lateral transport mechanism for moving said coupling in a front-back direction relative to said press, and a vertical transport mechanism for moving said coupling vertically;

said transfer system also having a longitudinal transport drive system for the or each mounting head capable of moving the or each mounting head independently of any other mounting head, if any, in a left-right direction relative to said press.

12. A transfer system according to claim 11 wherein said vertical transport mechanism includes a supporting body mounted for vertical movement on said support beam and said lateral transport mechanism includes a horizontally extending, elongate support member mounted for substantially horizontal movement on said supporting body.

13. A transfer system according to claim 12 wherein said supporting body is a L-shaped housing having a vertical housing section and a horizontal housing section rigidly connected to each other, said elongate support member is slidably mounted in said horizontal housing section, and said lateral transport mechanism includes a lateral belt drive assembly including a lateral drive belt connected to said elongate support member and a drive motor mounted on said supporting body and having an output shaft operatively connected to a drive pulley that engages said drive belt whereby, during use of said transfer system, rotation of said drive pulley causes said support member to move in the front-back direction.

14. A transfer system according to claim 12 wherein the or each mounting head includes a carriage assembly mounted for horizontal movement along said support beam, said supporting body is mounted for vertical movement on said carriage assembly, and said longitudinal transport drive system is connected to said carriage assembly in order to move the mounting head in a left-right direction during use of said transfer system.

15. A transfer system according to claim 14 wherein said longitudinal transport drive system comprises a belt drive system including a primary drive belt mounted on said support beam and extending in the lengthwise direction of the support beam and a drive motor mounted on said carriage assembly and having an output shaft operatively connected to a drive pulley that engages said primary drive belt.

16. A transfer system according to claim 14 wherein said supporting structure comprises two vertical, elongate supporting assemblies, a respective one of which is arranged at each end of said support beam, said support beam is mounted for vertical movement on the two supporting assemblies, and a vertical power drive arrangement is provided for moving said support beam vertically on said two supporting assemblies.

17. A transfer system according to claim 13 wherein said drive motor is mounted on said vertical housing section at a location spaced above said horizontal housing section, said drive pulley is rotatable about a horizontal axis, and said lateral drive belt has a vertical belt section located within and extending along said vertical housing section.

18. A transfer system according to claim 11 wherein there are two of said at least one mounting head, the two mounting heads are mounted on said support beam for horizontal movement along said support beam, and the transfer system includes said elongate bar which extends between and is connected to both of said mounting heads, said mounting heads

being movable together and in the same manner during use of said transfer system.

19. A transfer system according to claim 12 wherein there are two of said at least one mounting head, the two mounting heads are mounted on said support beam and are adapted for independent horizontal movement along said support beam, and said longitudinal transport drive system comprises two longitudinal drive assemblies each including a primary drive belt mounted on the support beam and extending in the lengthwise direction of the support beam and a drive motor mounted on its respective mounting head and having an output shaft operatively connected to a drive pulley that engages its respective primary drive belt.

20. A carriage apparatus for use in a transfer system for transferring workpieces between successive die stations in a stamping press having a left side, a right side, and front and back sides, said carriage apparatus comprising:

- a primary carriage body adapted for mounting on a horizontally extending support beam for substantially horizontal movement along said support beam in a left-right direction relative to said press;

- a primary drive mechanism adapted for moving said carriage body selectively in said left-right direction, said primary drive mechanism including a carriage drive motor mounted on said carriage body;

- a secondary support body mounted for vertical movement on said carriage body;

- a secondary drive assembly connected to said secondary support body and adapted to move said secondary support body vertically relative to said carriage body;

- a horizontally extending, elongate support member mounted for substantially horizontal movement on said secondary support body in a front-back direction relative to said press and having an inner end that can be moved away from secondary support body and towards the stamping press during use of the apparatus, a coupling being provided at said inner

end for connecting an elongate bar having a series of workpiece holders mounted thereon; and

a power drive system connected to said elongate support member and adapted to move said elongate support member horizontally relative to said secondary support body.

21. A carriage apparatus according to claim 20 wherein said secondary support body is a L-shaped housing having a vertical housing section and a horizontal housing section rigidly connected to each other, said elongate support member is slidably mounted in said horizontal housing section, and said power drive system is a belt drive assembly including a drive belt connected to said elongate support member and a further drive motor mounted on said secondary support body and operatively connected to a drive pulley in order to rotate same during use of said carriage apparatus, said drive pulley engaging said drive belt.

22. A carriage apparatus according to claim 21 wherein said further drive motor is mounted on said vertical housing section at a location spaced above said horizontal housing section and said drive pulley is rotatable about a horizontal axis by said further drive motor.

23. A carriage apparatus according to claim 21 wherein said secondary drive assembly comprises a secondary drive motor and a ballscrew drive unit operatively connected at one end thereof to said secondary drive motor for rotation thereby, said ballscrew drive unit including a ballscrew rotatably mounted on said primary carriage body.

24. A carriage apparatus according to claim 20 wherein said primary drive mechanism comprises a primary belt drive assembly that includes said carriage drive motor and a flexible primary drive belt adapted for mounting on said support beam, said carriage drive motor being operatively connected to a rotatable primary drive pulley that engages said primary drive belt.

25. A carriage apparatus according to claim 21 wherein said elongate support member is a tubular member having a guide rail mounted thereon and extending in the lengthwise direction of said support member and wherein said horizontal housing section has ball slide means for slidably engaging said guide rail.

26. A carriage apparatus according to claim 20 wherein said carriage body includes a substantially L-shaped support bracket having a vertical leg with two opposing vertically extending sides, said support body being slidably mounted on one of these two opposing sides for vertical movement and the other of said two opposing sides being adapted for slidably connecting said carriage body to said support beam for said horizontal movement.

27. A carriage apparatus for use in transfer system for transferring workpieces between successive die stations in a stamping press having a left side, a right side, and front and back sides, said carriage apparatus comprising:

- a primary carriage body adapted for mounting on a horizontally extending support for substantially horizontal movement on said support in a left-right direction relative to said press during use of the carriage apparatus;

- a secondary support body mounted for vertical movement on said carriage body;

- a secondary drive assembly connected to said secondary support body and adapted to move said secondary support body vertically relative to said carriage body;

- a horizontally extending, elongate support member mounted for substantially horizontal movement on said secondary support body in a front-back direction relative to said press and having an inner end that can be moved away from secondary support body and towards the stamping press during use of the apparatus, a coupling being provided at said inner end for connecting an elongate bar having a series of workpiece holders mounted thereon; and

a belt drive assembly adapted to move said elongate support member horizontally relative to said secondary support body, said belt drive assembly including a drive belt connected to said elongate support member, a drive motor mounted on said secondary support body at a location spaced above said elongate support member, and a drive pulley operatively connected to said drive motor for rotation thereby and engaging said drive belt, said drive pulley being rotatable about a horizontal axis that is perpendicular to a longitudinal axis of said elongate support member.

28. A carriage apparatus according to claim 27 wherein said secondary support body is a L-shaped housing having a vertical housing section and a horizontal housing section rigidly connected together, said elongate support member is slidably mounted in said horizontal housing section, and said drive motor is mounted on one side of said vertical housing section.

29. A carriage apparatus according to claim 28 wherein said secondary drive assembly comprises a secondary drive motor and a ballscrew drive unit operatively connected at one end thereof to said secondary drive motor for rotation thereby, said ballscrew drive unit including a ballscrew rotatably mounted on said primary carriage body.

30. A carriage apparatus according to claim 27 including a primary power drive assembly adapted for moving said primary carriage body selectively in said left-right direction and connected to said primary carriage body.

31. A carriage apparatus according to claim 27 wherein said carriage body includes a substantially L-shaped support bracket having a vertical leg with two opposing vertically extending sides, said support body being slidably mounted on one of the two opposing sides for vertical movement and the other of said two opposing sides being adapted for slidably

connecting said carriage body to said horizontally extending support for said horizontal movement.